**(patterns | incidence | rates) of (limb | pere(i)opod | leg | cheliped) (autotomy | loss)**

Title : Rates and patterns of limb loss in a large snow crab (*Chionoecetes opilio*) population

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**Summary:**

Crustaceans may lose their pereiopods (i.e. walking legs or chelipeds) due to predation, competition or handling during fishing. Missing pereiopod patterns were analyzed using survey data from a population of snow crab (*Chionoecetes opilio*) in the southern Gulf of Saint Lawrence. Pereiopod loss rates were regressed over sex, maturity stage and size of the animal, as well as the condition of its carapace. Spatio-temporal variation was also considered.

Large differences were found between the sexes. Whereas rates for immature male crab were generally low and constant over all sizes, they were found to be two to three times higher in sexually mature versus immature male crab. This pattern is even apparent in newly moulted crab, with crab which had moulted in previous years showing only a moderate increase in pereiopod loss. In addition, the loss rates were twice as high in smaller mature males than for larger ones. Such results strongly hint at mating

competition as the main mechanism for pereiopod loss.

Pereiopod loss rates in females were about 60% those observed in males. Mature females similarly showed higher rates than immature ones, with newly moulted females having a moderate increase in pereiopod rates than older mature females. This may be a function of the longer life expectancy of mature female versus male snow crab. Rates for females showed little variation with size.

In males the 2nd pereiopods had the highest loss rates whereas the chelipeds and 5th pereiopods had the lowest. In females, the 2nd and 5th pereiopods had the highest rates whereas the chelipeds had a rate less than half that of any other pereiopod.

Annual changes in the pereiopod rates show some correlation with underlying population dynamics, most notably high abundance levels in large males. Results suggest that intra-specific competition between crab may be the main drivers in the patterns observed.

**Methodology:**

Survey blah, blah …

Missing crab walking legs and chelipeds were noted for all crab, for most years.

 In some years, crab smaller than 40 mm CW were not sampled for missing legs.

 Only legs which were naturally lost were considered in the following analyses.

 Regenerated legs, representing legs which were lost in previous moults, were also not considered in the analyses.

**Factors related to pereiopod loss:**

Latent (unobserved)

* Moulting
* Predation
* Competition
* Mating
* Fishing (through by-catch)

Observed:

* Sexual (i.e. morphometric) maturity (competition and mating)
* Time elapsed since last moult (i.e. carapace condition).
* Parity (crab side)
* Crab size (carapace width (mm)
* Year (encompasses all of the latent factors which vary through time).
* Location (encompasses all of the latent factors which vary through space).

**Bibliography:**

**Patterns:**

McVean, A., Findlay, I., **1979**. The incidence of autotomy in an estuarine population of the crab ***Carcinus maenas***. J. Mar. Biol. Assoc. UK 59, 341–354.

Jie He, Yang Gao, Wei Wang, Jianjun Xie, Hui Shi, Gengshen Wang, Wenjun Xu, **2016**. Limb autotomy patterns in the juvenile swimming crab (***Portunus trituberculatus***) in earth ponds. 463, 189-192.

Dvoretsky, A.G., Dvoretsky, V.G., **2009**. Limb autotomy patterns in ***Paralithodes camtschaticus*** (Tilesius, 1815), an invasive crab, in the coastal Barents Sea. J. Exp. Mar. Biol. Ecol. 377, 20–27.

Smith, L.D., **1990**. Patterns of limb loss in the blue crab, ***Callinectes sapidus*** Rathbun, and the effects of autotomy on growth. Bull. Mar. Sci. 46, 23–36.

**Effects:**

Claxton, W.T., Govind, R.W., Elner, R.W., **1994**. Chela function, morphometric maturity, and the mating embrace in male snow crab, ***Chionoccetes opilio***. Can. J. Fish. Aquat. Sci. 51, 1110–1118.

He, J., Wu, X.G., Cheng, Y.X., **2016**. Effects of limb autotomy on growth, feeding and regeneration in the juvenile ***Eriocheir sinensis***. Aquaculture 457, 79–84.

Juanes, F., Smith, L.D., **1995**. The ecological consequences of limb damage and loss in decapod crustaceans: a review and prospectus. J. Exp. Mar. Biol. Ecol. 193, 197–223.

Quinitio, E.T., Estepa, F.D.P., **2011**. Survival and growth of mud crab, ***Scylla serrata***, juveniles subjected to removal or trimming of chelipeds. Aquaculture 318, 229–234.

Robinson, M.H., Abele, A.G., Robinson, B., **1970**. Attack autotomy: a defense against predators. Science 169, 300–301.

Slos, S., Block, M.D., Stoks, R., **2009**. Autotomy reduces immune function and antioxidant defence. Biol. Lett. 5, 90–92.

Smith, L.D., Hines, A.H., **1991**. The effect of cheliped loss on blue crab ***Callinectes sapidus*** Rathbun foraging rate on soft-shelled clams Mya armaria L. J. Exp. Mar. Biol. Ecol. 151, 245–256.

Zhao, H.L., He, J., Wu, X.G., Long, X.W., Liu, H., Cheng, Y.X., **2015**. A study of limb autotomy patterns of juvenile Chinese mitten crab (***Eriocheir sinensis***) reared in earth ponds. J. Biol. 32, 10–13 (in Chinese with English abstract).